



## **Flammable, High-Pressure Industry in a Populated Coastal Flood Zone?**

Public Safety and Emergency Response Aspects  
Of a Proposed Methane Gas Compressor in Weymouth

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## **Public Safety and Emergency Response Aspects Of a Proposed Gas Compressor Station in Weymouth, MA**

### Executive summary

Physicians for Social Responsibility (PSR) represents the voices of more than 50,000 physicians and health professionals on the greatest threats to human health. In this report, Greater Boston PSR puts forward our concerns about disaster and emergency response hazards of a methane gas compressor station that Spectra-Enbridge Energy proposes to build in Weymouth, Massachusetts.

Our group includes physicians with pre-hospital medicine, mass casualty medicine and disaster preparedness expertise. We have reviewed the construction plans, visited the proposed site, and interviewed local EMS, police, fire and town officials. We find it alarming that plans to build this highly flammable, high-pressure gas infrastructure in such an inappropriate location have advanced this far.

- The proposed site is in a residential area, **far too densely populated** for heavy infrastructure and **already burdened by many explosive and hazardous material** sites
- Compressor stations for methane gas are **known to explode or catch fire**; they are not usually built in densely populated areas.
- Residents living nearby, particularly children, the elderly and the disabled, **could not be safely evacuated** in the event of an emergency.
- The site itself is a small peninsula **prone to flooding** with even moderate storm surges, let alone a hurricane storm surge, and **is frankly inappropriate for building any new infrastructure** – much less potentially explosive infrastructure.

We thus feel compelled to add our voices as physicians and public health experts to those of citizens, technical experts and political leaders – including the mayors of Weymouth and the neighboring towns of Quincy and Braintree, all of the region's state legislators, U.S. Congressman Stephen Lynch, and U.S. Senators Elizabeth Warren and Ed Markey – who oppose this construction project. **We urge Governor Charlie Baker to protect the health of Massachusetts residents and to deny Spectra-Enbridge a coastal zone construction permit**, which is one of the next regulatory steps in this process. We also urge officials responsible for public safety to do appropriate due diligence and ask hard questions about this controversial plan to locate explosive infrastructure in a Massachusetts community, for the main purpose of pumping more methane north for sale abroad. **Public safety officials could and should recommend against building the compressor.**

## A Potentially Explosive Compressor Station Threatens Critical Adjacent Infrastructure

Methane gas is flammable and explosive. Pressure in interstate pipelines ranges from 200 to 1,500 pounds per square inch (PSI); this is built up by compressor stations, such as the one proposed for Weymouth, which is intended to increase pressure in the existing Algonquin pipeline system to deliver more gas north through New England and Canada.

The proposed site for the compressor in Weymouth is a small artificial peninsula – created in the early 20<sup>th</sup> century from cinder, coal ash, and brick from torn-down buildings – with wetlands on either side. (We have inspected the site and the fill is exposed on the west side due to recent storm surge erosion.)



Sewage pump station

Exposed cinder and coal ash, west coast of proposed construction site



The compressor would be wedged on 4.3 acres between the Massachusetts Water Resources Authority (MWRA) sewage pump station – its massive sewage pipes, which move 60 million gallons of sewage per day, run along the fence-line of the proposed compressor station – and a new bridge that carries 32,000-plus commuters a day.

The sewage pump station was built after Massachusetts was sued in federal court for pumping untreated sewage into Boston Harbor, a lawsuit that resulted in the MWRA and a \$3.9 billion cleanup project. The sewage pump station alone, crucial to that work, could be a reason not to site highly explosive infrastructure here. Staff working at the pump house would be trapped between the Fore River and the compressor station in event of any disaster; in fact, the entire pump house is inside the blast radius of every potential explosion model (see below). If the sewage pump station went inoperable, a large stretch of the South Shore region would not be able to pump sewage forward.

The bridge over the Fore River, which connects Quincy and Weymouth, is another piece of crucial regional infrastructure that would be threatened by any compressor station disaster. The bridge re-opened in 2017 after a \$244 million construction project, and it is a regional obsession: Its center rises to allow shipping into the Fore River basin, the busiest port in the region after Boston itself, and traffic is so bad when the bridge is up that bridge raisings are announced days in advance, so the community can plan accordingly.



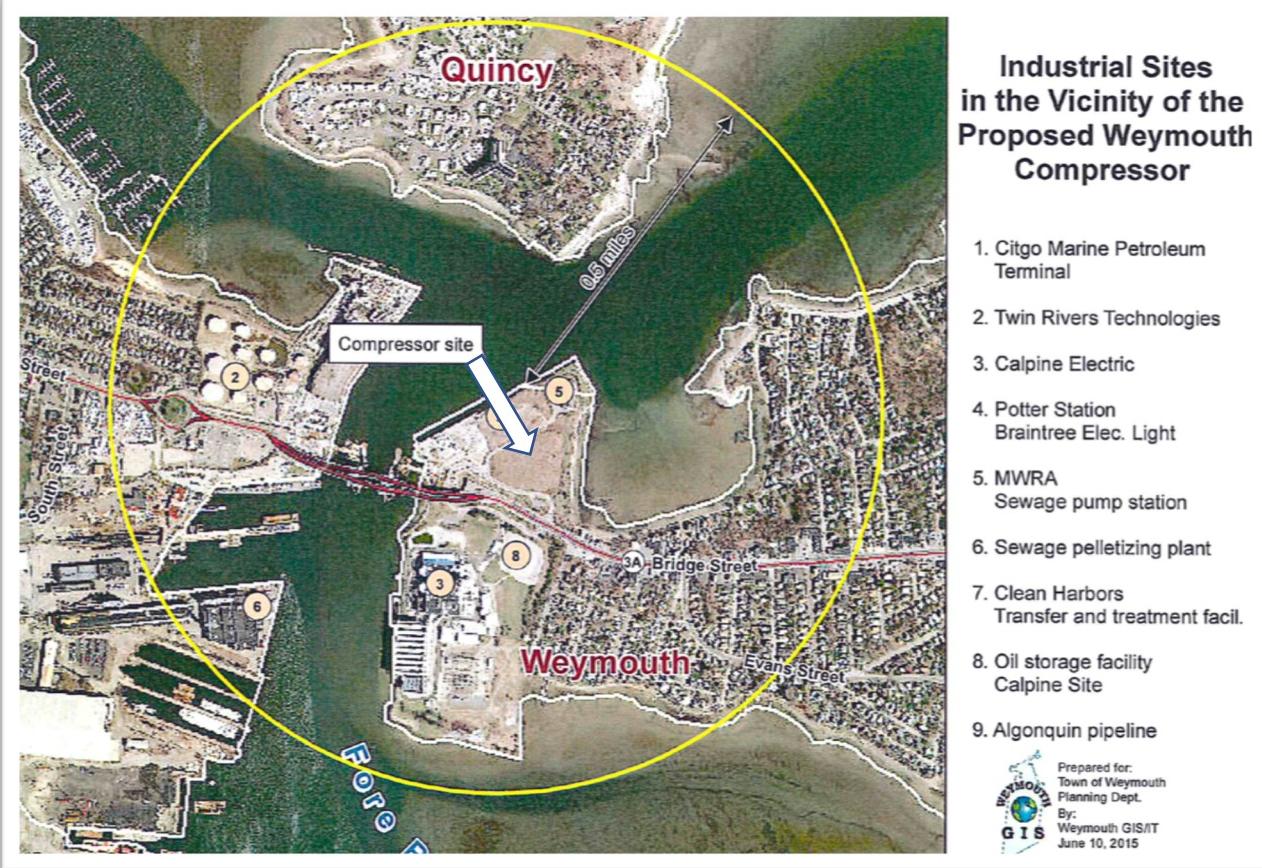
Just perpendicular across the bridge from the proposed compressor site is a third major piece of infrastructure, the Calpine Fore River Energy Center, a 730-megawatt electric power generating plant that runs on either diesel or methane gas. Pipelines carrying methane gas to the electric station already run from Spectra's existing pipeline network underneath the Fore River bridge. The power station also has hazardous material onsite, including, per one recent survey<sup>1</sup>, more than 2 million gallons of diesel fuel.

And even this is only a sampling – the bridge, the sewage pumping station, the electric power station – of the critical and even explosive infrastructure already present in this busy port and shipping region. In fact, according to the Mayor's Office of Weymouth<sup>2</sup>, within less than a mile of the proposed compressor station are:

- 1) A gasoline and oil depot (Citgo Marine Petroleum Terminal)
- 2) A chemical plant (Twin Rivers Technologies)
- 3) Two power plants (Calpine and Braintree Electric Light Department)
- 4) The MWRA regional sewage pump station
- 5) A sewage pelletizing plant (MWRA);
- 6) A hazardous waste transfer and treatment facility (Clean Harbors);
- 7) Smaller oil storage facilities and tanks (Calpine); and
- 8) The Algonquin Pipeline itself

<sup>1</sup> Weymouth Health Department presentation to Local Emergency Planning Committee, October 2018, accessed at <http://vp.telvue.com/preview?id=T01133&video=339742&fbclid=IwAR3n8uNwbH2ZbE5ZBjB5L51vVFPZrvsiWJvOtz8g-TXRER4u0bX6SgoLFQ>

<sup>2</sup> Town of Weymouth Press Release. March 21, 2016. Accessed at: [https://www.weymouth.ma.us/sites/weymouthma/files/u71/2016-03-21\\_press\\_release\\_-\\_beaton\\_ltr\\_cumulative\\_impacts.pdf](https://www.weymouth.ma.us/sites/weymouthma/files/u71/2016-03-21_press_release_-_beaton_ltr_cumulative_impacts.pdf)



Critical infrastructure within one mile (yellow circle) of proposed compressor station, as provided by Town of Weymouth.

### Emergency Evacuation of Nearby Residents Would Be Extremely Challenging

The surrounding area is densely populated. **Within just a half-mile** of the proposed site, according to the Weymouth mayor's office<sup>3</sup>, **there are 964 households alone**. As local first responders have reported to us, it is notoriously difficult to get emergency response vehicles in and out of the area even on a good day. On a bad day -- for example a disaster at the compressor station, which would make the Fore River bridge inaccessible -- emergency response teams and evacuations would be extremely challenged. **Within a 2-kilometer (1.2-mile) radius of the proposed compressor station site, there are schools with 3,100 students<sup>4</sup>, elderly housing, nursing homes and a mental health facility.**

As physicians -- including physicians with experience in emergency medical systems and disaster preparedness -- we have deep concerns about locating a high-pressure

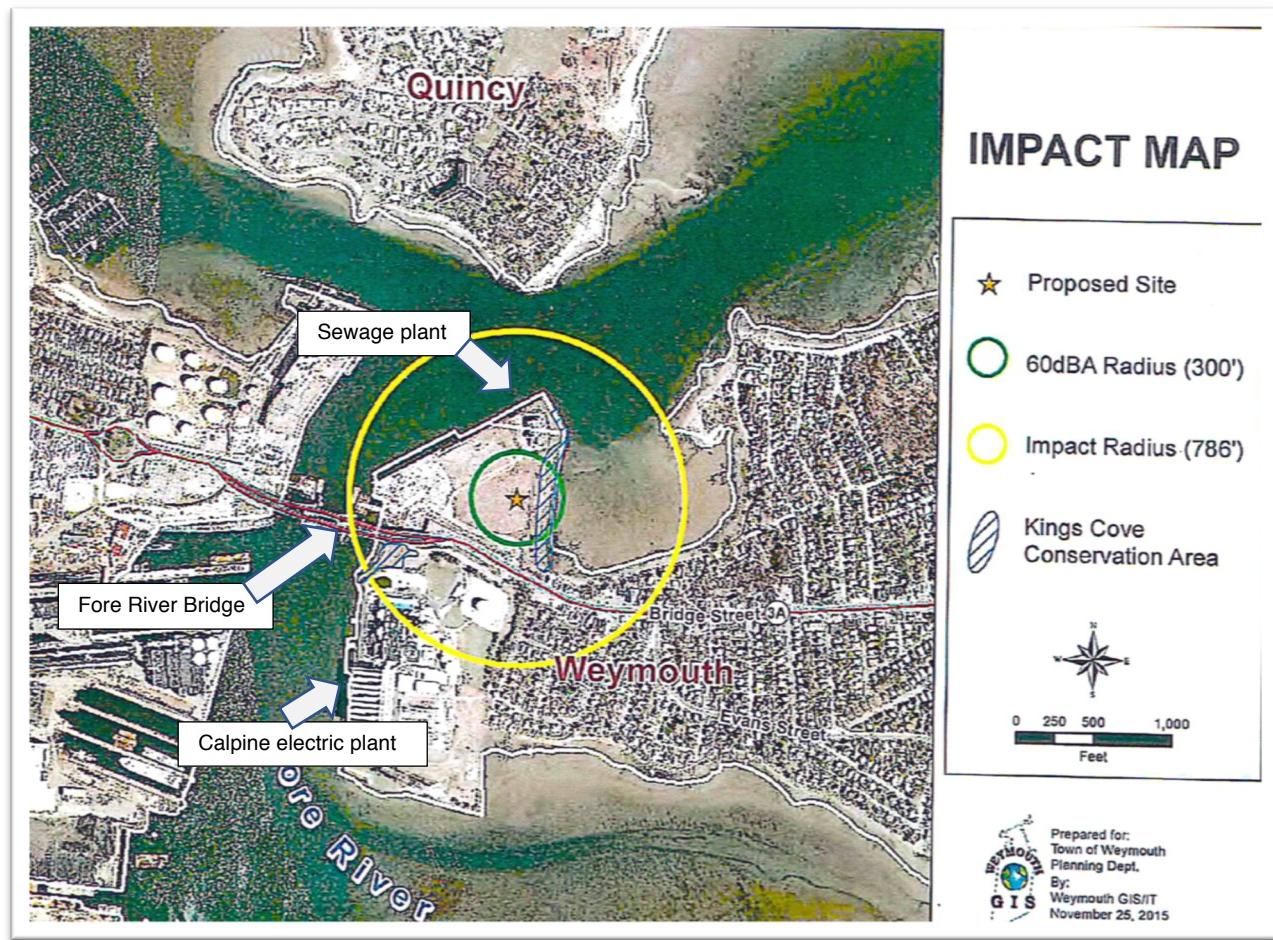
<sup>3</sup> Town of Weymouth Press Release. March 21, 2016. Accessed at:

[https://www.weymouth.ma.us/sites/weymouthma/files/u71/2016-03-21\\_press\\_release\\_-\\_beaton\\_ltr\\_cumulative\\_impacts.pdf](https://www.weymouth.ma.us/sites/weymouthma/files/u71/2016-03-21_press_release_-_beaton_ltr_cumulative_impacts.pdf)

<sup>4</sup> As per Spectra Energy's Resource Report 5, Section 5.2.8, as cited by Fore River Residents Against the Compressor Station at: <https://static1.squarespace.com/static/56afc3b92b8dded389a27cc2/t/5963dc51099c01b47e46e9d0/1499716690193/Data+and+sources+for+homes%2C+children%2C+schools.pdf>

gas compressor in this densely populated area. **We consider it highly doubtful that enough emergency transportation could be available to make a timely evacuation of school children, senior citizens in elderly housing, mental health patients, and nursing home patients if an accident were to occur at the site of the proposed compressor station.**

## The Proposed Compressor Station Represents an Explosive Danger



Explosion impact radius (yellow circle) of both existing pipelines and proposed compressor station, based on Enbridge-Spectra data, provided by Town of Weymouth. (The green circle demarcates estimates of noise levels from the plant.)

In September 2018, a series of 80 simultaneous methane gas explosions in the Merrimack Valley damaged more than 130 buildings, injured 23 people (including two firefighters) badly enough to require hospital evaluations, and killed one person. According to preliminary findings by the National Transportation Safety Board, workers were upgrading a series of cast-iron gas pipes first installed in the early 1900s, and a low-pressure system that usually experiences about 0.5 psi of gas pressure was accidentally filled with about 6 psi. **The proposed compressor station will be dealing with gas under up to 250 times more pressure than in the Merrimack Valley disaster**, while relying upon upgrades to a similarly old regional pipeline infrastructure in need of repair.

Compressor stations in particular, and interstate methane gas pipelines generally, are rarely built in such densely populated areas – especially nestled among so much other hazardous and explosive infrastructure. This is because methane gas pipeline and compressor station disasters have catastrophic potential, as demonstrated by the Merrimack Valley disasters and a sampling of other recent explosions:

- *Armada Township, MI, January 30, 2019:* An equipment malfunction at a Consumers Energy natural gas compressor station in rural Michigan caused a dramatic fire and an explosion that was felt miles away.<sup>5</sup> It occurred during unusually cold and windy temperatures (a “polar vortex”) and took so much gas service off-line, the state of Michigan was sending emergency text messages to citizens for 2 days asking them to keep thermostats below 65 F.<sup>6</sup> **Notably, due to the cold and wind, gas that had been vented as part of a safety protocol kept a methane gas plume from dissipating – as industry officials usually insist will happen when gas is emergently vented -- and it instead spread across the ground until it hit a heat source more than 150 feet away, at which point it exploded.**<sup>7</sup>
- *Refugio, TX, February 2017:* A methane gas pipeline explosion in a sparsely populated area about 160 miles southwest of Houston could be seen for miles and shook homes 60 miles away.<sup>8</sup>
- *Salem Township, PA, April 2016:* An explosion of a Spectra methane gas pipeline in a rural area about 30 miles east of Pittsburgh **was so large that it showed up on local radar as a 40-mile long weather front.**<sup>9</sup> It destroyed one house 200 feet away, melted the siding off of a house 0.2 miles away, charred trees and telephone poles about a mile away, and led to the hospitalization of a man in his 20s with 3rd degree burns over 75% of his body. The explosion of this pipeline, which at the time was operating at about 1,000 psi, made a crater 30 feet wide, 50 feet long and 12 feet deep.<sup>10</sup> (For comparison, the proposed

**“Natural gas” or methane?**

Gas companies have succeeded in branding flammable gasses that are predominantly methane as “natural gas.” This is a marketing term with a reassuring connotation. The industry has succeeded in imposing this preferred term because methane shipments include traces of other gases. But as it is overwhelmingly methane, we prefer to use the scientific term here.

<sup>5</sup> “Appeals flood consumers: Use less gas after utility fire.” *The Detroit News*. January 31, 2019. Accessed at: <https://www.detroitnews.com/story/news/local/macomb-county/2019/01/30/no-injuries-after-fire-armadanatural-gas-facility/2721353002/>

<sup>6</sup> “Consumers energy chief: We’re making changes after natural gas crisis.” *Bridge Michigan*. February 20, 2019. Accessed at: <https://www.bridgemici.com/michigan-environment-watch/consumers-energy-chief-were-making-changes-after-natural-gas-crisis>

<sup>7</sup> *Ibid*

<sup>8</sup> “Pipeline explosion felt 60 miles away.” *KHOU TV*. February 15, 2017. Accessed at: <https://www.khou.com/article/news/local/texas/pipeline-explosion-felt-60-miles-away/285-408507389>

<sup>9</sup> “Anatomy of a pipeline explosion: Salem PA.” *The Cost of the Pipeline*. October 4, 2016. Accessed at: <https://thecostofthepipeline.com/2016/10/04/anatomy-of-a-pipeline-explosion-salem-pa/>

<sup>10</sup> “PA Pipeline Explosion: Evidence of Corrosion Found.” *NPR*. May 4, 2016. Accessed at: <https://stateimpact.npr.org/pennsylvania/2016/05/04/pa-pipeline-explosion-evidence-of-corrosion-found/>

#### **Greater Boston PSR & fossil fuels**

As physicians concerned about the twin man-made threats to human survival – climate change and nuclear weapons – GBPSR would generally oppose major infrastructure that locks our energy system more firmly into greenhouse-gas generating fuels that threaten all of our futures. This is especially so when Massachusetts is not meeting its renewable energy goals even as climate change is accelerating and opportunities to mitigate it are running out. That said, we are *uniquely* opposed to the Weymouth compressor station as a truly dangerous and unjust project, for the reasons outlined in this and other reports. Details at [www.gbpsr.org](http://www.gbpsr.org).

Weymouth compressor will be operating at more than 1,400 psi and the edge of the site is across a small parking lot from the foundation of the heavily-trafficked Fore River bridge.)

- *Watford City, ND, December 2015:* An explosion of a methane compressor station in North Dakota cracked drywall and knocked pictures off the walls of homes a mile away. Locals described it as “like a truck had hit the house going 75 mph” or like someone “had picked up the house and dropped it.”<sup>11</sup>

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<sup>11</sup> “Compressor Station Explosion Raises Concerns,” *McKenzie County Farmer*. January 5, 2016. Accessed at: <http://www.watfordcitynd.com/?id=10&nid=3533>

## The Blast Radius Around the Weymouth Compressor Site

According to federal regulations, the Potential Impact Radius (PIR) defines a circle within which the potential failure of a pipeline could have “significant impact on people or property.”<sup>12</sup> It is calculated by the formula:

$$PIR = 0.69 d \sqrt{p}$$

Where  $d$  is *pipeline diameter*, and  $p$  is the *maximum pressure* in the pipeline.

The square root of the pressure in pounds per square inch (if pressure is 1,000 psi, the square root is 31.6) is multiplied by the pipeline diameter in inches, then multiplied by a correction factor for the explosive power of methane of 0.685. The result is the potential impact radius, in feet.<sup>13</sup>

In the case of the Weymouth compressor, the pipelines in use would be either 24 or 30 inches, and the methane might be compressed to anywhere from 250 to 1,500 psi, depending on supply and demand, weather conditions and other factors.

The town of Weymouth, citing estimates from Spectra-Enbridge, puts the PIR of any sudden, accidental explosion at the existing Algonquin pipeline at the site at 786 feet (see above graphic). That is indeed a reasonable estimate for the PIR of a sudden explosion at either the existing pipeline or the proposed compressor station itself, when using the government’s recommended PIR calculation (for example, a 30-inch pipeline with methane pressurized to 1,500 psi results in a PIR of 801 feet).

It is worth noting, however, that the PIR is designed to model a sudden, isolated pipeline disaster – which usually occurs on a large plot of land, usually sited in a rural area. As noted in a letter<sup>14</sup> sent January 9, 2019, to Governor Baker by 14 of the South Shore’s legislators, other compressor stations in New England tend to be on land plots ranging from 34 acres to 104 acres in sparsely populated zones, while the Weymouth site is a paltry 4.3 acres nestled among a dense population – again, with 984 households within a half-mile, and 3,100 students going to school within a mile – and, perhaps worst of all, with multiple other hazardous and explosive industrial concerns abutting the site.

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<sup>12</sup> “Pipeline Safety: High Consequence Area Identification Methods for Gas Transmission Pipelines.” A Notice by the Pipeline and Hazardous Materials Safety Administration. December 13, 2016. Accessed at:  
<https://www.federalregister.gov/documents/2016/12/13/2016-29880/pipeline-safety-high-consequence-area-identification-methods-for-gas-transmission-pipelines>

<sup>13</sup> CFR 192.903. Accessed at:  
<https://www.govinfo.gov/content/pkg/CFR-2018-title49-vol3/xml/CFR-2018-title49-vol3-part192.xml#seqnum192.903>

<sup>14</sup> Letter to Governor Baker January 2019 signed by 14 state legislators. Accessed at:  
<https://static1.squarespace.com/static/56afc3b92b8dded389a27cc2/t/5c37c3cab8a0451f8eff44bc/1547158475609/Ltr+to+Gov+Baker++HIA+Response+and+Air+Permit+Request+1.9.19.pdf>

A review of the radius of the PIR shows that the sewage pump station would be inside the blast and fire impact radius of a sudden unexpected disaster, as would half of the Fore River Bridge and half of the Calpine electric power plant – including the fuel storage tanks on site (see aerial map above).

It is notable that **the PIR for the existing pipeline in Weymouth does not take into account other infrastructure that could be ignited**, from cars on the bridge to diesel fuel at the power plant.

In its filings with the Federal Energy Resource Committee, Spectra-Enbridge replied to concerns that a disaster at the proposed compressor station could damage the new Fore River Bridge. (For example, causing the bridge to collapse, as happened with the Interstate 85 overpass bridge in Atlanta in March 2017, after construction materials stored under the bridge caught fire.<sup>15</sup>) The company reported that “if ignition were to occur during gas venting” – i.e., if methane gas were to explode – its models found heat levels of 37.5 kilowatts per square meter ( $\text{kW}/\text{m}^2$ ) at a distance of 282 feet, and “less than 15 kilowatts per square meter” at the bridge foundation, which they put at 450 feet from any explosion. They argued that “less than 15 kilowatts per square meter” of heat energy is not enough to melt or damage the Fore River bridge structure.<sup>16</sup> That could be debated. But even so, the company is describing an extreme high-energy fire that would be lethal to anyone caught within its radius. A standard federal government computer model, ALOHA (discussed below), predicts a 100% mortality to anyone exposed for one minute to temperatures as hot as  $10 \text{ kW}/\text{m}^2$ .

The PIR and modeling the company has already filed suggests that in a **moderately bad scenario, first-responders could be dealing with a bridge of blazing cars that they would not even be able to reach**; and they would find it near impossible to evacuate the neighboring schools and nursing homes, much less any surviving staff at the sewage pump station.

**In a worst-case scenario, a compressor station explosion could spread** to involve other infrastructure. The diesel fuel tanks of the Calpine electric plant could be ignited, for example. Or even worse, when the Fore River bridge is open, tankers full of gasoline go in and out through the Fore River -- the bridge can be raised to accommodate them - - headed to the Citgo Marine Petroleum Terminal. They pass within a stone’s throw of the proposed site, and a review of the PIR map shows that part of the waterways used would fall within any blast radius. The tankers only pass through the Fore River when the tide is coming in, so if the explosions and fires were timed to engulf a passing tanker, there would be chemicals and fuels floating on water, on fire, moving up river

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<sup>15</sup> “Fire Damage to Bridge and Subsequent Collapse, Atlanta, Georgia, March 30, 2017.” Highway Accident Brief. National Transportation Safety Board. Accessed at: <https://www.ntsb.gov/investigations/AccidentReports/Reports/HAB1802.pdf>

<sup>16</sup> Spectra-Enbridge filing with Federal Energy Regulatory Commission of May 2, 2016. Cited as Exhibit B to Pre-Filed Direct Testimony of John Hinckley, Q.E.P., “In the Matter of Algonquin Gas Transmission LLC.” OADR Docket Nos. 2017-011 and 2017-012 and Waterways Application No. W16-4600. Commonwealth of Massachusetts Executive Office of Energy and Environmental Affairs, Department of Environmental Protection.

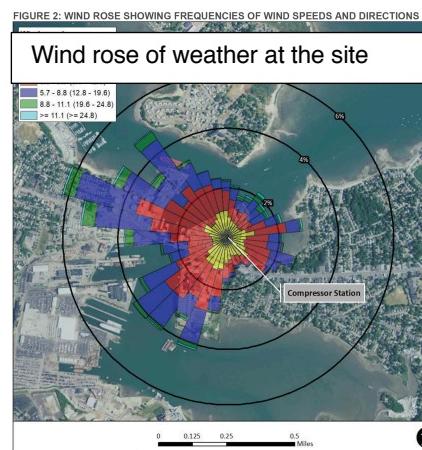
past the electric power station and to other facilities like the Citgo oil and gasoline depot, and also to multiple homes on the waters.

Moreover, even these sudden explosion scenarios do not cover the worst possibilities. They do not, for example, take into account uncontrolled leaks that allow large explosive methane gas clouds to build prior to ignition, as discussed in the next section.

## The Danger of Large Methane Gas Leaks

Huge clouds of methane gas have been known to leak at compressor stations. For example, a cloud containing 200 tons of methane gas leaked at a Pennsylvania compressor station in 2017. Fortunately, that huge cloud dissipated without exploding.<sup>17</sup> The industry usually assumes methane will rapidly dissipate into the atmosphere, but as demonstrated by the January 2019 compressor station explosion in Michigan referenced above, sometimes wind and weather conspire to keep a methane cloud concentrated in place and flowing slowly across the ground surface.

GeoInsight Inc., an engineering firm with expertise in air quality permitting and monitoring, was hired by the Town of Weymouth to evaluate risks associated with possible accidental methane gas leaks at the proposed compressor station. The company modeled such leaks using the ALOHA software, a program developed by U.S. government experts at the National Oceanic and Atmospheric Administration and the Environmental Protection Agency. ALOHA is used to model threat zones from clouds of hazardous gas releases, and has been used, for example, by the Spectra-Enbridge company itself to establish threat zones around other pipeline projects.



GeoInsight used ALOHA to model a hypothetical scenario: the rupture of a 24-inch pipeline at the center of the compressor station, pressurized at 800 psi, that released 14 tons of methane before the company was able to stop the leak after 2 minutes.<sup>18</sup> (Again, for comparison: **The gas leak at a Pennsylvania compressor station two years ago released not 14 tons, but 200 tons of methane**).<sup>19</sup> The scenario assumed usual weather and wind maps for the region (the same Spectra-Enbridge used in its air quality applications) to model resulting clouds of methane concentrated at potentially explosive levels.

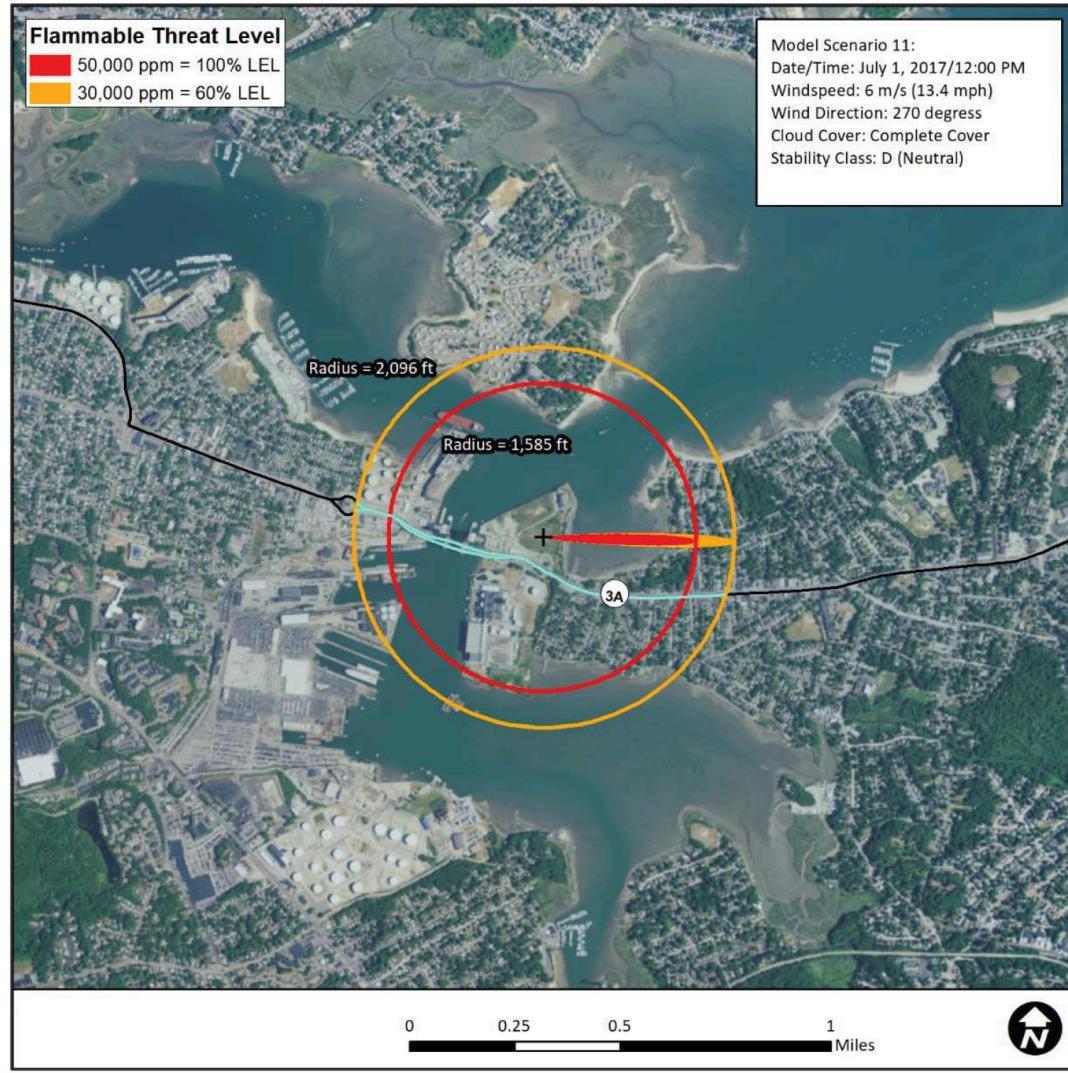
“An accidental release at the facility could produce flammable emissions, which, if ignited could injure or kill individuals on surrounding properties,” reported the GeoInsight researchers. “Flammable emissions could travel up to approximately 4,000 feet downwind in the event of a release. If ignited, thermal radiation could kill a person within one minute of exposure out to approximately 450 feet from the point of ignition and injure a person within one minute of exposure out to approximately 1,000 feet from the point of ignition.”

<sup>17</sup> “Susquehanna County, public remained in dark about big methane leak.” *Associated Press*. September 25, 2017. Accessed at: <http://www.witf.org/news/2017/09/susquehanna-county-public-remained-in-dark-about-big-methane-leak.php>

<sup>18</sup> “Weymouth Compressor Station Threat Zone Modeling.” GeoInsight, Inc. Project 8242-000. October 25, 2018. As cited in “Pre-Filed Direct Testimony of John Hinckley, Q.E.P., In the Matter of Algonquin Gas Transmission LLC.” OADR Docket Nos. 2017-011 and 2017-012 and Waterways Application No. W16-4600. Commonwealth of Massachusetts Executive Office of Energy and Environmental Affairs, Department of Environmental Protection.

<sup>19</sup> “Weymouth Compressor Station Threat Zone Modeling.” GeoInsight, Inc.

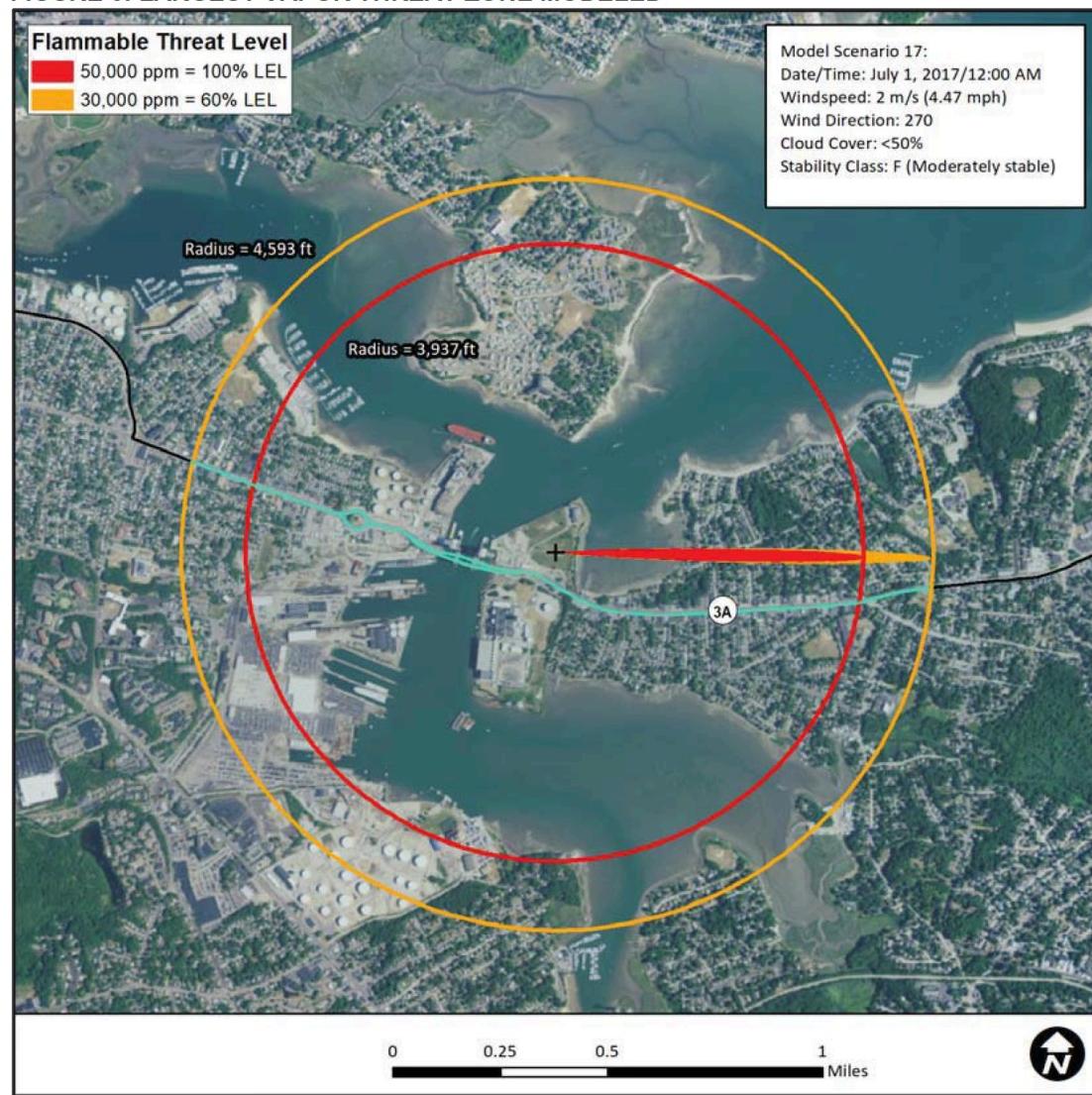
FIGURE 5: AVERAGE SIZED VAPOR THREAT ZONE MODELED



The “vapor threat zone” is the area downwind from a natural gas leak where methane concentration in the air equals or exceeds the lowest concentration at which it will ignite. This is called the Lower Explosive Limit (LEL). (For planners interested in more conservative modeling, ALOHA will also estimate vapor threat zones extending out even further, to methane concentrations at 60% of the LEL and 10% of the LEL. In this report we will only discuss clouds at 100% of the LEL, corresponding to the red circle on the graphic above.)

The *average-sized cloud* of methane at explosive concentrations is 1,585 feet in this modeled scenario. Note this would cover the entire Fore River bridge, the entire sewage pump station, the entire Calpine electrical plant, and hundreds of homes in both Weymouth and across the river in Quincy.

FIGURE 6: LARGEST VAPOR THREAT ZONE MODELED

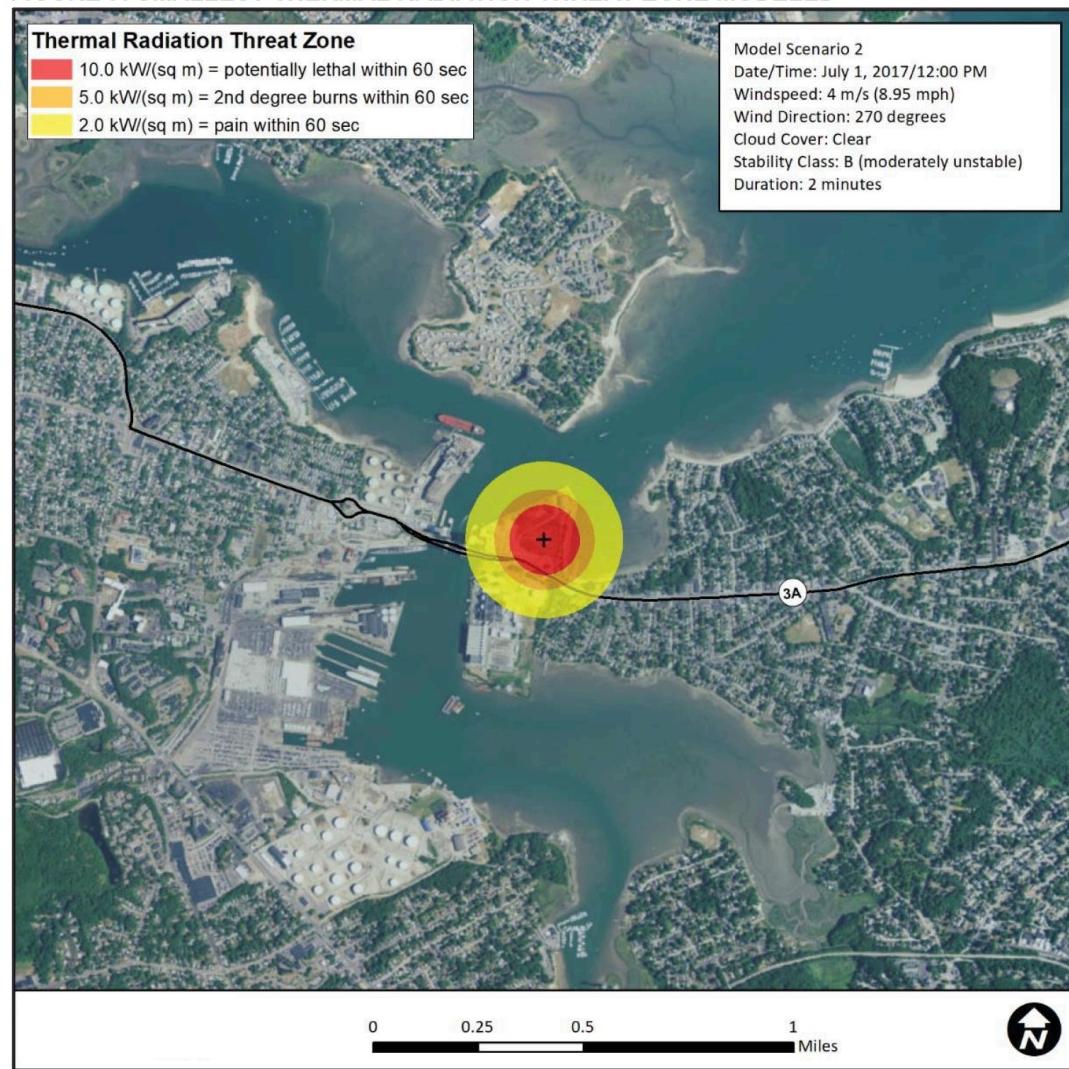


The *largest cloud* of methane at explosive concentrations extends to 3,937 feet in this modeled scenario. This exceeds the half-mile radius in which more than 964 households have been identified. It is approaching the 1.2-mile (6,336-foot) radius in which town officials have identified schools with 3,100 students<sup>20</sup>, elderly housing, nursing homes and a mental health facility.

Again: This is GeoInsight's model, using the ALOHA software, of a somewhat arbitrary scenario of a 2-minute methane gas leak that releases 14 tons of methane. The Pennsylvania compressor station leak in 2017 cited above (which, fortunately, dissipated without exploding) released 200 tons of methane.

<sup>20</sup><https://static1.squarespace.com/static/56afc3b92b8dded389a27cc2/t/5963dc51099c01b47e46e9d0/1499716690193/Data+and+sources+for+homes%2C+children%2C+schools.pdf>

FIGURE 7: SMALLEST THERMAL RADIATION THREAT ZONE MODELED



The “thermal radiation threat zone” is the area where heat from ignition of a gas leak can do physical harm. A large cloud may ignite at its edge – for example, as it comes into contact with cars running across the Fore River bridge – but even so, most of the heat and explosive damage will be in the cloud’s center, where methane gas will be most concentrated.

ALOHA models three levels of heat threat, and for the scenario GeoInsight modeled – a 2-minute leak of 14 tons of methane gas that then ignites – the heat damage is mapped on the graph above.

**Red** corresponds to a  $10 \text{ kW/m}^2$  thermal radiation threat zone. It extends 446 to 459 feet. It would be **lethal to anyone who spent 60 seconds** in this zone. (For many people, it would take more than 60 seconds to escape a zone of this size).

**Orange** corresponds to a  $5 \text{ kW/m}^2$  thermal radiation threat zone. It extends 633 to 643 feet. It would cause **2<sup>nd</sup> degree burns to anyone who spent 60 seconds** in this zone. Second degree burns cause blisters and scarring and are extremely painful.

**Yellow** corresponds to a  $2 \text{ kW/m}^2$  thermal radiation threat zone. It extends to 991 feet. It would cause **pain and burns to anyone who spent 60 seconds** in this zone.

GeoInsight's report notes the following specific impacts on people in the areas around the compressor station that would be seen in this methane cloud ignition scenario:

- King's Cove, a recreational park next to the compressor: "second degree burns to mortality."
- The sewage pumping station: "second degree burns to mortality."
- Sections of Route 3A, the highway that runs across the Fore River bridge: "Pain less than second degree burns, second degree burns, mortality."
- Surrounding residential areas: "Second degree burns to pain less than second degree burns."
- Fore River Bridge: "Pain less than second degree burns."
- Calpine electric power plant: "Pain less than second degree burns."

Again: This scenario modeled physical injuries from the ignition of the methane cloud. It is silent on additional injuries from, say, ignition of cars themselves on the roads, or secondary explosions at the Calpine plant. Calpine workers caught outside during a methane cloud explosion could expect injuries from that, but also might then face secondary explosions of their own infrastructure not modeled here.

It is precisely because of the explosive dangers of methane infrastructure that its heaviest components are usually sited in rural, unpopulated areas, and generally *not* built next door to power plants, gasoline tanker ship lanes, major highways, and amidst hundreds of homes and thousands of school children.

## A Unique Concern: The Proposed Compressor Site Is Threatened by Flooding

Current flood and storm surge maps show that the entire area proposed for this compressor station is in a hurricane flood zone.



As global climate change warms waters, sea level is rising and storm surges are already more severe than historical averages. This is widely predicted to only become a more severe problem over time.

Any decision to build new infrastructure in a hurricane flood zone is already questionable. Any decision to build dangerous, explosive infrastructure on a low-lying coastal peninsula already prone to flooding would seem to be shortsighted and foolhardy in the extreme. It would only be additional irony that the same hydraulically fractured methane gas, being pumped through the region *en route* to sale abroad, would itself be a driver of the increasing flood risks to a proposed compressor station.

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